REMARKS

This is intended as a full and complete response to the Office Action dated August 29, 2001 having a shortened statutory period for response set to expire on November 29, 2001. Please enter the following amendments and reconsider the claims pending in the application for reasons discussed below. Claims 1-13 and claims 18-26 remain pending in the application after entry of this amendment. Claims 27-29 have been canceled without prejudice. Claims 30-34 have been added herein. Applicants believe that no new matter has been introduced in this response.

Claims 9, 13, and 18-26 stand rejected under 35 U.S.C. 112 second paragraph. The Examiner asserts that the wording used in part b of claim 1 is confusing and should be rewritten. The Examiner points out that the word "ethant" in claims 9 and 13 should be replaced with the word "etchant". The Examiner asserts that the scope of claims 18 and 21 fails to match the body of the claims since no means for conducting an etching step is positively recited in the body of the claims as is recited in the preamble of the claims. The Examiner states that claims 13, and 19-26 would be allowable if rewritten to overcome the rejection(s) 35 U.S.C. 112 second paragraph.

Applicants have amended the claims changing the term "ethant" to etchant in claims 9 and 13, clarified claims 18 and 19-26 by including an etching step. The applicants believe the claims 9, 13, 18, and 19-26 are now in condition for allowance.

Claim 12 stands objected to as being dependent upon a rejected base claim. The Examiner states that claim 12 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicants have rewritten claim 12 in independent form and believe claim 12 is in condition for allowance.

Claims 1, 3-7, 10-11, and 18 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,756,400 (*Ye*). The Examiner states that *Ye* discloses an etching chamber which is used to etch Al wiring layers on a Si wafer where the etch chamber is pre-treated with a plasma which is used to remove etch byproducts left on the Al walls of the etcher. The Examiner states that the plasma cleaning gas may be any of SF_6-C_{12} or SF_6-0_2. The plasma cleaning gas is primarily comprised of SF_6 with a small quantity of either Cl_2 or 0_2 present in the plasma etchant. When SF_6-0_2 is used to

clean the Al walls of the etcher, a layer of AlO_xF_y is formed onto the surface of the Al walls. Further, the Examiner states that when SF_6-Cl_2 is used to clean the Al walls, no deposit of AlF_x is formed on the surface of the walls as long as the concentration of F remains below a target value. The Examiner also states that the Cl_2 in the plasma reacts with the Al walls of the etcher to inhibit the formation of AlF_x on the Al walls of the etcher. The Examiner states, an Al layer on the surface of a Si wafer which is masked with a photo resist etch mask is then plasma etched in a plasma comprised of Cl_2-BCl_3-N_2 after the etcher has been cleaned using the above process. The Examiner also states that the plasma etchant reacts with the substrate to form a chlorinated etch polymer residue which coats or contaminates the Al walls of the etcher. The Examiner states that the Al walls of the etcher are then cleaned again using any of the plasma cleaning gases taught above before processing additional wafers through the etcher. The Examiner asserts that it would have been inherent that the rate of recombination of the Cl_2 gas with the Al walls in the etcher is different from that of the SF_6 gas with the Al walls based upon the fact that the process taught above employs the same etch gasses as those which are claimed by the Applicants. The Applicants respectfully traverse the rejection.

Ye teaches a plasma process for cleaning the interior surfaces of processing chambers directed to the dry etching of accumulated contamination residues on the chamber surfaces when a substrate is not positioned in the chamber. The method includes introducing a cleaning gas mixture of a halogen-containing gas, then activating a plasma substantially free of oxygen species and contacting the contaminant residues with the activated gas to volatilize the residues. (*See*, abstract, col. 3, lines 51-66, col. 4, lines 1-6 and lines 60-66, col. 6, lines 6-30, col. 7, lines 9-33).

Ye does not teach, show, or suggest a method of etching substrates. Further, Ye does not teach, show, or suggest etching substrates by introducing at least a first etchant into the chamber selected to minimize material deposited on the chamber internal surfaces during etching and when disassociated, comprises a first recombination rate with the deposited material substantially different than a second recombination rate with the internal surfaces as recited in claims 1 and claims 3-5. *Ye* does not teach, show, or suggest a method of etching a substrate where during etching,

a disassociated first etchant deposits material on the internal surfaces of the chamber at a first rate and a disassociated second etchant deposits material at a second rate less than the first rate as recited in claims 7-11. *Ye* does not teach, show, or suggest during substrate etching depositing a film on the internal surfaces of the chamber where a first recombination rate of one or more plasma constituents with the internal surfaces is substantially equal to a second recombination rate of the one or more plasma constituents with the film as recited in claim 18. Applicants submit that the rejection has been obviated and respectfully requests the Examiner to withdraw the rejection.

Claim 2 stands rejected under 35 U.S.C.103 (a) as being unpatentable over U.S. Patent No. 5,756,400 (*Ye*). The Examiner states that *Ye* fails to disclose the specific deposition rate on the Al walls of the etcher which is claimed by the Applicant. The Examiner asserts it would have been obvious to one skilled in the art to conduct the plasma etching process taught such that the specific deposition rates of etch byproducts which are claimed by the Applicant is achieved on the internal surfaces of the etcher walls based upon the following assertions: It would have been desirable to conduct the plasma etching process taught by *Ye* in a manner which minimizes the amount of etch byproducts formed on the internal surfaces of the etcher in order to reduce the possibility of particles flaking off the walls of the etcher during the etching process. The Examiner further asserts that such particles can undesirably lead to the contamination of the surface of wafers processed through the etcher during the etching process causing an undesirable formation of process defects in the wafers being etched in the etcher. The Applicants respectfully traverse the rejection.

Ye teaches a plasma process for cleaning the interior surfaces of processing chambers directed to the dry etching of accumulated contamination residues on the chamber surfaces when a substrate is not positioned in the chamber. The method includes introducing a cleaning gas mixture of a halogen-containing gas, then activating a plasma substantially free of oxygen species and contacting the contaminant residues with the activated gas to volatilize the residues. (*See*, abstract, col. 3, lines 51-66, col. 4, lines 1-6 and lines 60-66, col. 6, lines 6-30, col. 7, lines 9-33).

Ye does not teach, show, or suggest a method of etching substrates. Further, Ye does not teach, show, or suggest etching substrates by introducing at least a first

etchant into the chamber selected to minimize material deposited on the chamber internal surfaces during etching and when disassociated comprises a first recombination rate with the deposited material substantially different than a second recombination rate with the internal surfaces as recited in claim 2. Thus, the Examiner has not established a *prima facie* showing of obviousness. Therefore, Applicants submit that the rejection has been obviated and respectfully requests the Examiner to withdraw the rejection.

Claims 6-11 stand rejected under 35 U.S.C.103 (a) as being unpatentable over U.S. Patent No. 5,332,468 (*Engelhardt*). The Examiner states that *Engelhardt* discloses a process for etching a poly-silicon layer on top of a gate oxide layer on the surface of a Si wafer using a plasma comprised of Cl_2-Br_2. The Examiner states that the etch process of *Engelhardt* is conducted in a parallel plate etcher in which a quartz liner surrounds the anode and the cathode. The Examiner states that *Engelhardt* fails to specifically disclose the specific etch process conditions which are claimed by the Applicant. The Examiner asserts that it would have been obvious to employ any of a variety of different etch process conditions in the process taught by *Engelhardt* including those which are specifically claimed by the Applicant. The Examiner also asserts that these process conditions are well known variables in the plasma etching art, which are known to affect both the rate and quality of the plasma etching process. The Applicants respectfully traverse the rejection.

Engelhardt teaches a method for etching a material from a target and depositing that material on a substrate during an etching process. *Engelhardt* teaches the material being deposited on the substrate is the same material that is being etched from the substrate. Further, the material is deposited onto the exposed surfaces of the substrate at about the same rate as the material is removed from the substrate during the etching process. For example, *Engelhardt* teaches a method of sputtering an internal surface such as a quartz target on a SiO_2 layer within a chamber where a ring electrode and a ground electrode are covered by a quartz lining to form the target. Accordingly, the quartz target is eroded at a pre-determined rate to offset the erosion of an exposed SiO_2 layer by sputtering the quartz onto the exposed SiO_2 layer. (*See,* Abstract, col. 2, lines 1-24, lines 35-38, and lines 45-51, col. 5, lines 4-26).

Engelhardt does not teach, show, or suggest a method of etching a substrate where during etching, a disassociated first etchant deposits material on the internal surfaces of the chamber at a first rate and a disassociated second etchant deposits material at a second rate less than the first rate as recited in claims 6-11. Thus, the Examiner has not established a *prima facie* showing of obviousness. Therefore, Applicants submit that the rejection has been obviated and respectfully requests the Examiner to withdraw the rejection.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the method or process of the present invention. Having addressed all issues set out in the office action, the Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action. Accordingly, allowance of the claims is respectfully requested.

Respectfully submitted,

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APPENDIX

1. (Amended) A method of etching substrates in a chamber having [an] internal surfaces, comprising:

(a) introducing at least a first etchant into the chamber wherein the first etchant is selected to minimize deposition of a material on the internal surfaces; and

(b) striking a plasma in the chamber to cause disassociation of the first etchant [wherein the first etchant is selected to minimize deposition of a material on the internal surface and] wherein the disassociated first etchant comprises a first recombination rate [of the disassociated etchant on] with the material [is] substantially different than a second recombination rate [of the disassociated etchant on] with the internal surfaces.

2. (Amended) The method of claim 1, wherein a deposition rate at which the material is formed on the internal surfaces is less than about 30 Å/min.

3. (Amended) The method of claim 1, further comprising:

(c) cleaning the internal surfaces prior to (a).

4. (Amended) The method of claim 1, wherein the first etchant comprises [chlorine] Chlorine, Hydrogen chloride, and combinations thereof.

6. (Amended) A method of etching a substrate in a chamber having [an] internal surfaces, comprising:

(a) flowing at least a first etchant and a second etchant into the chamber, wherein a volumetric flow of the first etchant is greater than a volumetric flow of the second etchant; and

(b) striking a plasma in the chamber to cause disassociation of the first etchant and the second etchant, wherein the disassociated first etchant deposits material on the internal surfaces at a first rate and the disassociated second etchant deposits material on the internal surfaces at a second rate less than the first rate.

7. (Amended) The method of claim 6, wherein the first etchant comprises Chlorine, hydrogen chloride, and combinations thereof.

8. (Amended) The method of claim 6, wherein the second etchant comprises bromine, Hydrogen Bromide, and combinations thereof.

9. (Amended) The method of claim 6, wherein the first [ethant] etchant comprises chlorine and the second [ethant] etchant comprises bromine.

11. (Amended) The method of claim 6, further comprising cleaning the internal surfaces prior to (a).

12. (Amended) [The method of claim 6, further comprising] A method of etching a substrate in a chamber having internal surfaces, comprising:

(a) flowing at least a first etchant and a second etchant into the chamber, wherein a volumetric flow of the first etchant is greater than a volumetric flow of the second etchant;

(b) striking a plasma in the chamber to cause disassociation of the first etchant and the second etchant, wherein the disassociated first etchant deposits material on the internal surfaces at a first rate and the disassociated second etchant deposits material on the internal surfaces at a second rate less than the first rate; and

(c) flowing oxygen into the chamber.

13. (Amended) The method of claim 12, wherein the first [ethant] etchant comprises chlorine and the second [ethant] etchant comprises bromine.

18. (Amended) A method of etching a substrate, comprising:

(a) positioning [the] a substrate in a chamber having [an] internal surfaces;

(b) flowing a chemical mixture into the chamber;

(c) striking a plasma [in the chamber from] of the chemical mixture to form one or more plasma constituents, [and]

(d) depositing a film on the internal surfaces; wherein a first recombination rate of the one or more plasma constituents with the internal surfaces is substantially equal to a second recombination rate of the one or more plasma constituents with the film; and

(e) etching the substrate.

19. (Amended) [The method of claim 18,] A method of etching a substrate, comprising:

(a) positioning a substrate in a chamber having internal surfaces;

(b) flowing a chemical mixture into the chamber;

(c) striking a plasma in the chamber from the chemical mixture to form one or more plasma constituents,

(d) depositing a film on the internal surfaces, wherein a first recombination rate of the one or more plasma constituents with the internal surfaces is substantially equal to a second recombination rate of the one or more plasma constituents with the film; and

(e) etching the substrate, wherein the substrate comprises polysilicon and wherein the internal surfaces substantially comprises quartz.

20. (Amended) The method of claim 19, wherein the internal surfaces comprise[s] a liner disposed on a chamber body.

21. (Amended) A method of etching a substrate, comprising:

(a) inserting [the] a substrate into a chamber;

(b) flowing a chemical mixture into a chamber, the chemical mixture comprising:

(i) one or more of a bromine-containing fluid and a chlorine-containing fluid; and

(ii) a fluorine-containing fluid;

wherein a volumetric flow of the one or more of the bromine-containing fluid and the chlorine-containing fluid is at least 50% of the chemical mixture; [and]

(c) striking a plasma; and

(d) etching the substrate.

26. (Amended) The method of claim 21, [further comprising:

(c)] wherein etching the substrate comprises etching one or more layers from the substrate, wherein the one or more layers comprise silicon.